KAISEN
Energy Corp.

ATTACHMENT 1

INTRODUCTION

Cyclic Steam Injection (CSI) is an effective thermal recovery process, in which, several driving mechanisms define the success of the process; i.e. viscosity reduction, wettability alteration, gas expansion, etc. CSI was first used fortuitously in Venezuela in 1959. One of the steam injectors, in a steam drive project, began producing, after a blowout, in much better conditions than the producing wells surrounding it. Since then, it has been applied successfully on a world-wide basis. ("Current overview of Cyclic Steam Process." Johannes Alvarez and Sungyun Han, Journal of Petroleum Science Research July 2013). As mentioned numerous times in the literature, cyclic steam is the most forgiving of the improved recovery processes. Given that the same wellbore is used both for injection and production, the operating conditions are much better controlled than in any other process.

A review of global enhanced recovery projects done in 2010 by the World Petroleum Council highlights that thermal projects dominate. Overall production was in excess of 2 million barrels of oil per day (bopd) versus less than 750,000 bopd from all other enhanced recovery methods combined.

These thermal projects represented over 20% of world wide heavy oil production.

Closer to home, over the past several years, the development of small scale steam projects in the Saskatchewan Oil & Gas designated Lloydminster area or Area 1 has grown dramatically. In July 2016, eleven steam projects were operating at a combined rate of 81, 892 bopd, which represented 52.25% of the production from the Lloydminster area. Husky Energy will be adding another steam project at Edam West in the fourth quarter of 2016 making an even dozen operating projects. This would move thermal heavy oil production to approximately 55% of Lloydminster's heavy oil production.

Scotiabank introduced small scale thermal resource projects in their resource "playbook" with the October 2016 edition. The economics of the thermal projects rank within the top quartile of all resource plays in North America covered by Scotiabank.

The thermal strategy employed by Husky Energy the past several years has proven to be very successful for them. Their most recent investor presentation highlights favorable thermal project economics and a further fourteen projects with name plate capacity of 110,000 bopd.

HIGH LEVEL THERMAL

Data from over the 50+ years of enhanced recovery has been collected in order to develop screening criteria for a project. The most recent published paper that addresses this subject has utilized a data set of 1785 projects. ("Updated Screening Criteria for Steam Flooding Based on Oil Field Projects Data." Hama, Wei, Saleh and Bai, SPE Heavy Oil Conference – Canada, June 2014.)

Using the general screening guide developed above, the Kaisen Edam project would compare as follows:

Parameter	Guide	Edam	Favorable /Unfavorable
Oil Gravity (°API)	8 – 30	11	F
Viscosity (CP)	5,000,000	18,400	F
Porosity (%)	12 – 65	33	F
Oil Saturation (%)	35 – 90	80	F
Permeability (md.)	1 – 15,000	4,000 – 10,000	F
Reservoir Temp. (°F)	10 – 350	65	F
Depth (feet)	200 – 9,000	1,640	F
Net Pay (feet)	>20	33 - 66	F

In terms of the parameters outlined within the screening guide, the Kaisen Edam project ranks at the high end of favorable on all parameters ("Recent Developments and Updated Screening Criteria of Enhanced Oil Recovery Techniques." Aladasani & Bai, CPS/SPE International Oil Conference – June 2010.)

The other screening criterion highlighted in the literature is that a low percentage of water sensitive clays is desired for good injectivity, which is the case at Edam.

AREA THERMAL PROJECTS

As outlined on the attached spreadsheet, 16 steam projects in Western Canada have been reviewed and summarized. Three projects have been identified as "Projects of Interest" and are projects not located in the Lloydminster area but are projects a number of the directors of Kaisen are familiar with. The thirteen Lloydminster projects include that of Kaisen's at Edam. The Kaisen project ranks as follow in comparison to the other Lloydminster (Area 1) projects.

Parameter	Edam	Ranking
Depth (m)	500	9 shallower; 2 deeper
Net Pay (m)	10 - 20	6 the same; 1 thinner; 5 thicker
Porosity (%)	33	9 the same; 3 lower
Oil Saturation (%)	80	10 the same; 2 greater
Permeability (D)	4 – 10	4 the same; 8 less
Reservoir Temp. (°F)	18	6 greater; 3 the same; 3 less
Reservoir Pressure (kPa)	3350	6 greater; 2 the same; 4 less
Oil Gravity (°API)	11	8 greater; 4 the same
Viscosity (cp)	18,400	4 better; 8 worse
Transmissibility (md.-ft./cp)	18 - 72	3 better; 9 worse

PIKES PEAK

The project that compares very closely to what Kaisen has at Edam is the Husky project at Pikes Peak which is located about 25 miles to the north west. A cyclic steam project was initiated at Pikes Peak in 1981. A total of 79 wells were cyclic steam over a period of 5+ years. Once the reservoir pressure got too low for the steam cycles to be effective, the project was converted to steam drive. Using the data outlined previously, the two projects compare as follows:

Parameter	Edam	Pikes Peak
Formation	Waseca	Waseca
Depth (m)	500	500
Net Pay (m)	10 - 20	5 – 30
Porosity (%)	33	33
Oil Saturation (%)	80	80
Permeability (D)	4 – 10	4.5 – 10
Reservoir Temp. (°F)	18	18
Reservoir Pressure (kPa)	3350	3350
Oil Gravity (°API)	11	11
Viscosity (cp)	18,400	19,400
Transmissibility (md.-ft./cp)	18 - 72	18 - 39

Other than in some areas of Pikes Peak, the reservoir is thicker than Edam all other parameters are the same. Therefore; one should expect comparable performance under cyclic steam operations.

PRODUCTION PERFORMANCE

Of the five cyclic steam projects identified on the attached spreadsheets, all showed good performance. However; the projects at Atlee – Buffalo and Onion Lake were both very limited tests in terms of wells steamed plus on average only one steam cycle was performed. Multiple cycles were conducted at Bolney, Celtic and Pikes Peak, which are all fairly good analogs of Edam. Whereas all other projects within Area 1 of Saskatchewan went straight to steam drive. Multiple cycles were conducted at Bolney, Celtic and Pikes Peak. All the other projects within Area 1 of Saskatchewan went straight to steam drive. This is understandable given that industry norms on recovery suggest 10 - 40% recovery of original oil in place (OOIP) for cyclic, 50 to 60% of OOIP on steam flooding and 60 to 70% of OOIP on steam assisted gravity drainage (SAGD). Summary of the cyclic projects is attached.

The production analogy developed for Edam utilized an area within Pikes Peak with similar pay thickness, permeability (about 15% of the 79 steamed wells of Pikes Peak were cored and 1 well in the Edam project area was cored) and well spacing. The production profile that resulted represented a recovery factor at Pikes Peak of approximately 30% of OOIP whereas in the pilot area envisioned at Edam it would result in a 20% recovery factor after 4 cycles.

The wells cyclic steamed at both Bolney and Celtic appear to replicate the performance at Pikes Peak. Thus, the reservoir performance in this area is reasonably consistent.

CONCLUSION

Enhanced recovery through steam has passed the test of time. It has proven itself to be a very economic approach to maximizing recovery from heavy oil reservoirs. It has become the application of choice in heavy oil just as horizontal multi-stage sand fracturing has to tight light oil reservoirs.

The Edam project passes all the accepted technical screening tests as a candidate for enhanced recovery through steam.

The Edam project compares favourably from a reservoir and fluid characteristics basis to one of the most successful steam projects in Western Canada, Pikes Peak.

Given the three points outlined above, Edam Waseca pool is a great candidate to apply cyclic steam to enhance the production and reserve recovery.

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Summary of Steam Projects (ATTACHMENT #1)

Nov-16

	Projects of Interest			Saskatchewan Area 1 - Heavy												
Reservoir Parameter	*Atlee - Buffalo*	**Gemini**	*Kerrobert*	**Bolney**	*Celtic*	*Edam*	*Edam East*	*Edam West*	*Onion Lake*	**Paradise Hill**	*Pikes Peak*	**Rush Lake**	*Sandall*	**Senlac**	*Tangleflags*	**Vawn**
Formation	Glauconite	Grand Rapids	Waseca	Colony	G.P.	Waseca	G.P	Sparky	Cummings	Colony	Waseca	Sparky	Colony	Cummings	Lloydminster	Lloydminster
Reservoir Depth (m)	880	395	800	465	485	500	460	435	600	465	500	475	435	750	450	485
Net Pay (Average) (m)	5	25	10 to 20 (15)	10 to 20 (15)	10 to 20 (15)	10 to 20	10 to 20	10 to 20	15 to 34 (20)	10 to 20 (15)	5 to 30 (15)	10 to 30	10 to 30	8 to 16	10 to 28 (18.5)	10 to 20
Porosity (%)	29	33	32	31	32	33	33	33	33	31	33	33	33	33	33	33
Water Saturation (%)	20	20	20	20	20	20	20	20	20	20	20	20	22	15	20	15
Permeability (Darcies)	2 to 10	2.8 to 6.4	2 to 10	4 to 6	3 to 5	4 to 10	2 to 6	2 to 10	2.5 to 10	4 to 6	4.5 to 10	3 to 5	2 to 6	5 to 10	3 to 6	2 to 6
Reservoir Temperature (C)	30	17	27	18	16	18	22	17	23	18	18	23	17	29	19	24
Reservoir Pressure (kPa)	6500	3000	6600	3200	3300	3350	3900	3000	3975	3200	3350	4200	3000	5200	4075	4350
Oil Gravity (API)	15	12	11	14	12	11	11	13	11	14	11	13	12	12	13	11
Dead Oil Viscosity (cp)	4000	50000 to 280000	25000	12000	34000	18400	41000	38500	50000	12000	19400	28000	25500	5000	15000	38000
Transmissibility (md.-ft./cp)	24.61	2.29	11.81	20.51	14.06	18.72	4.8	7.67	8.2	20.51	18.39	9.37	10.29	59.06	18.21	5.18

Pikes Peak and Kaisen Edam parameters are very close matches

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Summary of Steam Projects (ATTACHMENT #1)

Nov-16

Parameter	*Atlee - Buffalo*	**Bolney**	*Celtic*	**Onion Lake**	*Pikes Peak*
# of Wells	7	55	8	2	79
# of Steam Cycles	8	204	31	2	322
Avg. Cycle/Well	1	4	4	1	4
Steam Injected (Bbls)	202432	16481778	1356830	114761	11527488
Steam /Cycle (Bbls)	25304	80793	43769	57381	35800
Oil Produced (Bbls)	204905	6414069	1211335	37798	7719322
Oil/Well (Bbls)	29272	116619	151417	18899	97713
CSOR	0.99	2.57	1.12	3.04	1.49